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The attached papers constitute a correct and accurate reproduction of the original documents of this patent application.

München, December 17, 2001
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The instant papers constitute a substantially correct translation of the attached Priority Certificate and text of German Patent Application DE 101 02 957.8 in the name of DR. JOHANNES HEIDENHAIN GmbH.

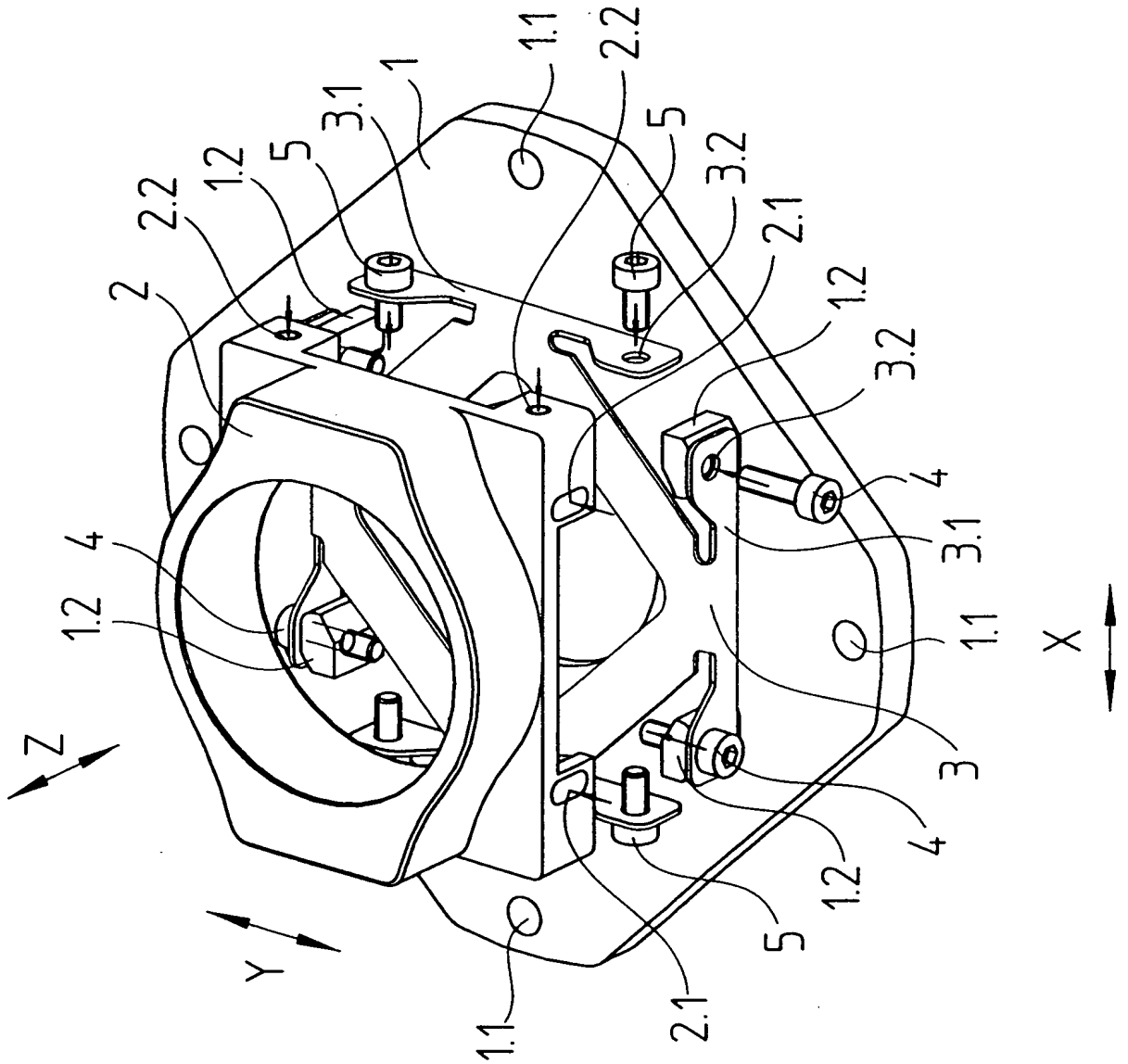
Olaf Bexhoeft — April 29, 2003

Olaf Bexhoeft
5316 Little Falls Road
Arlington, VA 22207-1522
USA

Abstract

Angle Measuring System

A coupling (3) in an angle measuring system permits radial and axial compensating movements of a stator (2) in respect to a base (1). Stops, which limit these compensating movements in such a way that damage to the coupling (3) is prevented, have been provided without additional components, in that first screws (4) fixed on the base (1) project into suitable openings (2.1) of the stator (2) (Fig. 2).



Angle Measuring System

The invention relates to an angle measuring system in accordance with the preamble of claim 1.

Angle measuring systems are employed, for example, for measuring the angular position of an engine shaft. For this purpose, the angle measuring system has a rotating element (rotor) and a static element (stator) in its housing. The rotor is fastened on the engine shaft, so that it follows all movements of the shaft and rotates along with the shaft in relation to the stator. The rotor has a graduation, which is scanned by a scanning unit of the angle measuring system fastened to the stator, and whose signals are employed for calculating the angle position of the shaft.

In this case the scanning unit, and therefore the stator, must be seated in such a way that they are connected with the motor housing in a torsion-proof manner in respect to the rotor. Each rotating movement of the stator would lead to an error in the measurement of the angular position. But the stator should be able to follow axial and radial movements of the shaft. In this way it is assured that the distance between the rotating graduation and the scanning unit does not change and a constant signal quality is obtained. This is achieved in that an appropriate coupling is provided between the stator and the base of the angle measuring system, which is fixedly connected with the motor housing. The base can be a portion of the housing of the angle measuring system here.

An angle measuring system with such a coupling is described in DE 299 11 508 U1, for example. In the course of the use of such angle measuring systems, tolerances are predetermined for the

maximum deflection of the motor shaft in the radial and axial direction. If these are exceeded, there is the danger of the destruction of the coupling, since it is made of a flexible, shaped sheet metal element.

An angle measuring system with a coupling of flexible sheet metal elements is also described in Japanese Laid-Open Utility Model 62-156822. There it is provided to limit the axial movements permitted by the coupling by means of a stop. However, the coupling used only permits axial movements, which are limited by the stop, which is constructed from additional components and is therefore expensive.

It is therefore the object of the invention to recite an angle measuring system, which limits the radial and axial movements of the stator by means of simply constructed stops and in this way prevents damage to the coupling between the stator and the base.

This object is attained by a device having the characteristics of claim 1. Advantageous embodiments ensue from the characteristics recited in the claims depending from claim 1.

The invention resides in that the stops at the base and at the stator of the angle measuring system limit the radial and axial movements of the stator in such a way that the coupling between the stator and the base cannot be damaged. Here, the stops in the axial and radial directions are constituted by screws, by means of which the coupling is fastened on the one end on protruding strips of the base, and which, at the other end, project into bores of a matching size in the stator. The stops in a further radial direction are constituted by the protruding strips of the base itself. In this way stops are obtained for the radial and axial movements of the stator in respect to the base without using additional components.

Further advantages, as well as details, of the present invention ensue from the following description of a preferred embodiment, making reference to the drawings. Shown are in:

Fig. 1, an angle measuring system on a motor,

Fig. 2, base, stator and coupling of the angle measuring system.

In Fig. 1 the base 1 of the angle measuring system 6 is connected with the housing of a motor 7, whose shaft 8 projects into the angle measuring system 6. The rotor 9 of the angle measuring system 6 has been pushed onto the shaft 8 and fastened in a torsion-proof manner. A graduation 10 is located on the rotor 9 and is scanned by a scanning unit 11. The scanning unit 11 is furthermore fastened on a stator 2 and provides the information regarding the angular position of the shaft 8. In order to keep the scanning distance between the scanning unit 11 and the graduation 10 on the rotor 9 constant, the stator 2 must be able to follow axial and radial movements of the shaft 8, which are transmitted via a bearing 12 to the stator 2. But the stator 2 must not follow rotating movements of the shaft 8 in respect to the base 1, since in that case the measurement of the angular position would be distorted. For this reason the stator 2 is fastened to the base by means of a coupling 3, only schematically represented, which does allow radial and axial movements of the stator, but otherwise constitutes a torsion-proof connection between the base 1 and the stator 2. Such a coupling 3 is described in DE 299 11 508 U1 mentioned at the outset, particular reference is made to Fig. 3 there.

Maximum values for radial and axial movements of the shaft 8 are provided to the user of the angle measuring system 6. If these should be exceeded for any reasons at all, it is advantageous to limit the mobility of the stator 2 by means of stops in order to prevent damage to the coupling 3.

Therefore Fig. 2 shows the fastening in accordance with the invention of the coupling 3 on the base 1, by means of which such stops result without additional components. The coupling 3 consists of a punched and bent sheet metal element, from which brackets 3.1 have been bent off and provided with bores 3.2. The coupling 3 is screwed together through these bores 3.2 by means of first screws 4 with four protruding strips 1.2 of the base 1, and by means of second screws 5 with four bores 2.2 at the stator 2. The first screws 4 project past the strips 1.2 into openings 2.1 in the stator 2. The openings 2.1 are of such a size that they permit a displacement of the stator 2 in respect to the base 1, until the edge of an opening comes into contact with a first screw 4. The openings 2.1 can have the approximate shape of elongated holes. Thus, the mobility of the stator 2 in respect to the base 1 is limited by stops in the axial direction Z and a radial direction X.

A further limitation of the movement of the stator 2 in a second radial direction Y is obtained in that the distance of the protruding strips 1.2 of the base 1 to the stator 2 has been selected to be such that the stator 2 comes into contact with the strips 1.2 when it has achieved its maximally permitted deflection in the direction Y. Thus, the first screws 4 must be of sufficient length for bridging this distance between the strips 1.2 and the stator 2 and to project into the openings 2.1 of the stator 2.

By means of the described fastening of the coupling 3 on the base 1, stops are obtained for deflections of the stator 2 in the axial and radial directions without requiring additional components. Thus the stator 2 and the coupling 3 can be very easily mounted.

In a variation of the invention, not shown, it is of course also possible to form stops in that the second screws 5 project into openings, also not shown, of the base 1.

In an advantageous manner, the freedom of movement of the stator 2 in respect to the base 1 provided by the stops will be selected to be greater than the tolerances for the radial and axial shaft movement specified to a customer, since in case of contact it will be necessary to absorb forces, for example by the bearing 12 of the shaft 8, something which should not occur during normal operations.

Claims

1. An angle measuring system having a coupling (3) for the torsion-proof connection of a base (1) with a stator (2), wherein the coupling (3) permits radial and axial compensating movements of the stator (2) in respect to the base (1), characterized in that stops at the base (1) and the stator (2) limit the compensating movements.

2. The angle measuring system in accordance with claim 1, characterized in that the coupling (3) is produced in one piece as a punched and bent element.

3. The angle measuring system in accordance with claim 1 or 2, characterized in that the coupling (3) is fastened on the base (1) by means of first screws (4), and on the stator (2) by means of second screws (5).

4. The angle measuring system in accordance with claim 3, characterized in that at least one of the stops is constituted by one of the first screws (4) projecting into an opening (2.1) of the stator (2).

5. The angle measuring system in accordance with claim 3, characterized in that at least one of the stops is constituted by one of the second screws (5) projecting into an opening of the base (1).

6. The angle measuring system in accordance with claim 4 or 5, characterized in that the opening is embodied as an elongated hole.

7. The angle measuring system in accordance with one of the preceding claims, characterized in that at least one of the stops is constituted by a projecting strip (1.2) on the base (1).

8. The angle measuring system in accordance with claim 7, characterized in that the coupling (3) is screwed to the projecting strip (1.2) of the base (1) by means of one of the first screws (4).

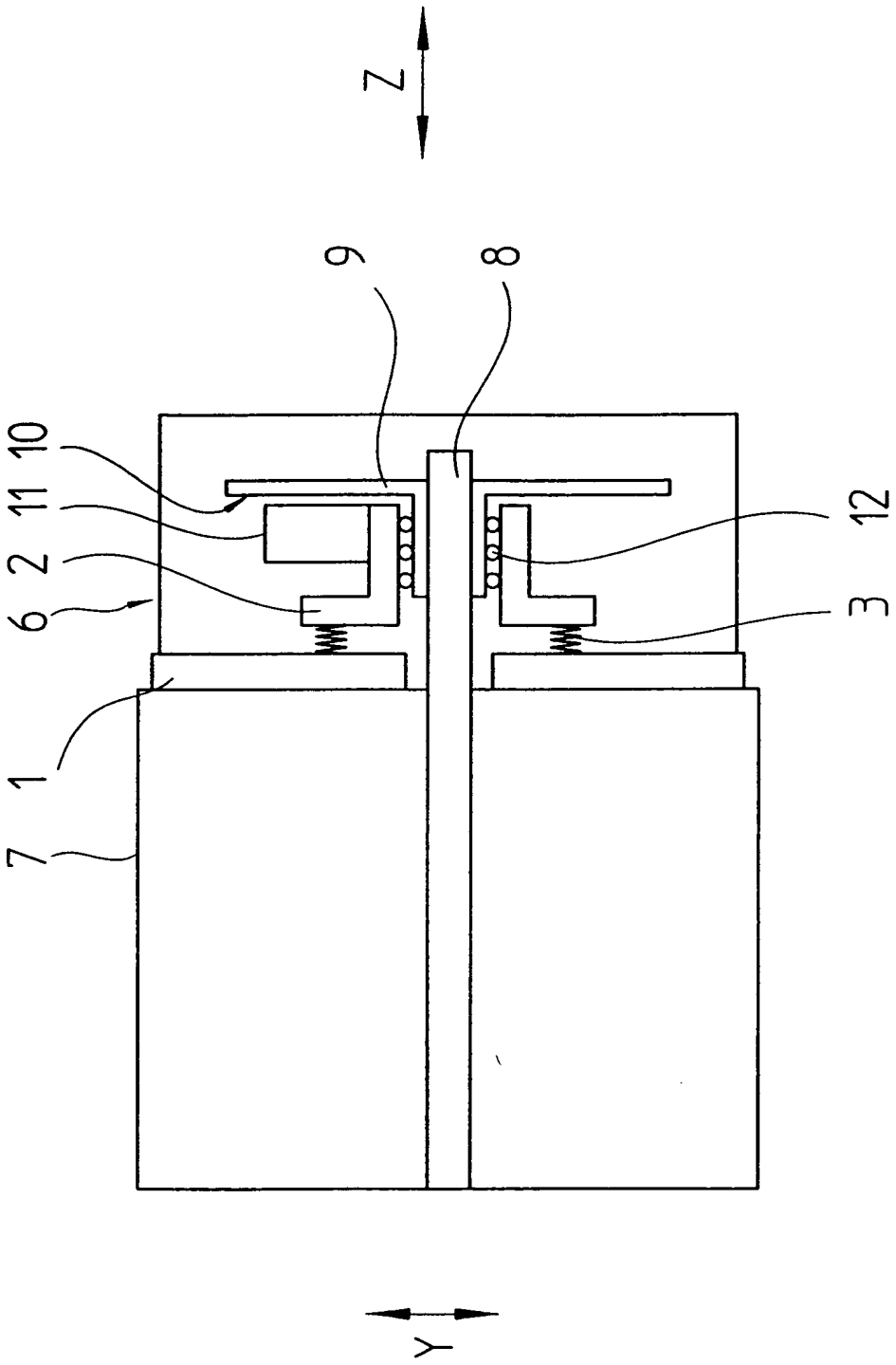


FIG. 1

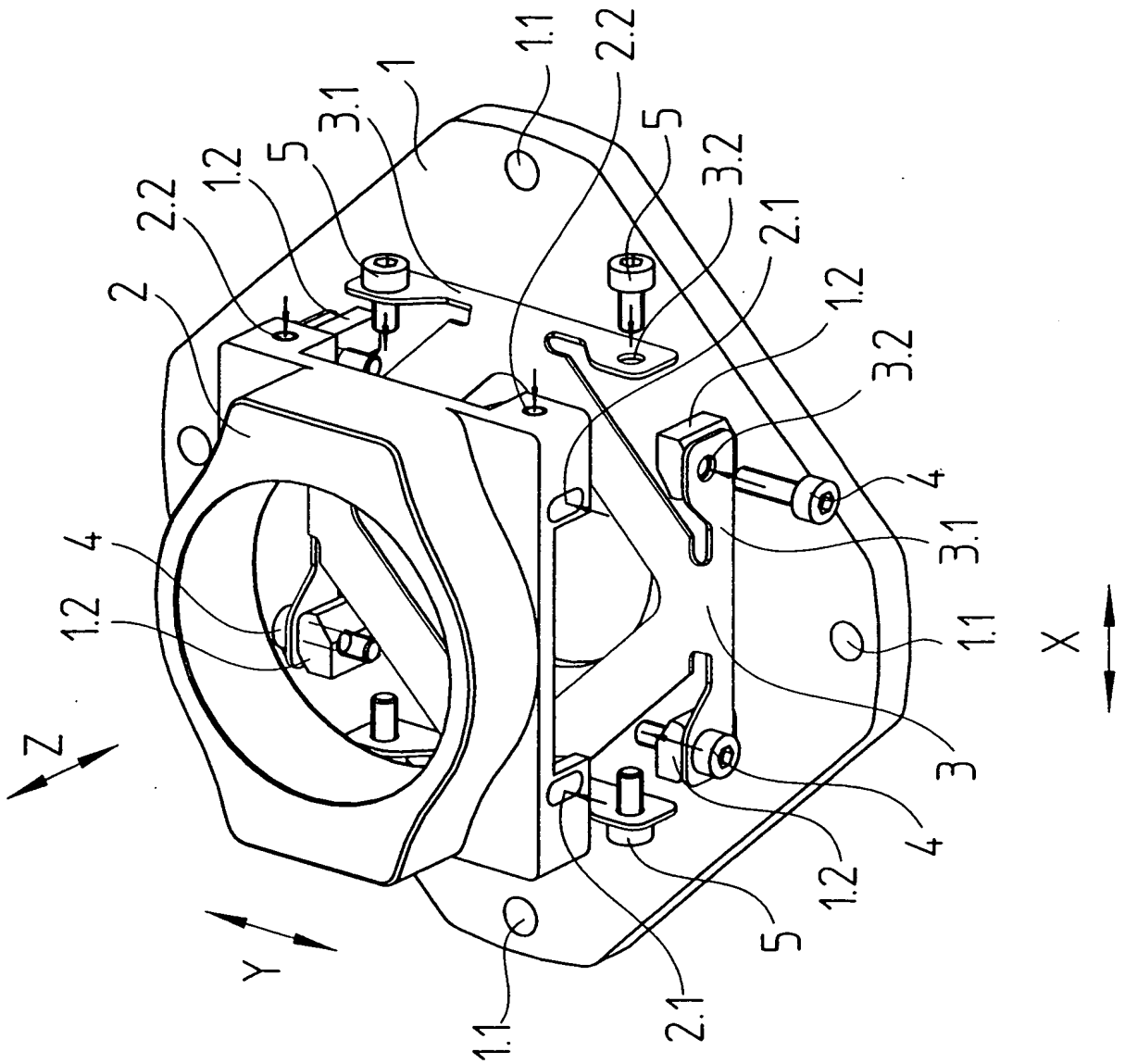


FIG. 2